

Prediction Methods Mashup: Setup and Use

1 Introduction

The Prediction Methods mashup is designed to demonstrate some different methods of triggering a prediction using Thingworx Analytics:

- API Realtime Prediction
- Analytics Manager: Event
- API Batch Prediction

It's probably most interesting to use this mashup and at the same time, review the Services code in Thing: concreteHelper. That way you will get a more detailed understanding of the different methods used to trigger a prediction.

The mashup uses a simple dataset showing different inputs to concrete (e.g. water, coarse aggregate, fine aggregate, age etc) and the resulting compressive strength. A prediction model predicts compressive strength based on different inputs entered.

The dataset was taken from this site:

<https://archive.ics.uci.edu/ml/datasets/Concrete+Compressive+Strength>

2 Thingworx Version

The entities were created and tested with TWX version 8.3

3 Resources

The following files are needed for this scenario:

Entities.twx	<i>Allows import of Thingworx entities</i>
concrete.json	<i>Needed to create an Analytics Dataset</i>
concrete.csv	<i>Needed to create an Analytics Dataset</i>

Optional files:

scriptSourceCode.zip *Source code for services in concreteHelper. Note that this file is only included for convenience as the source code is contained in Entities.twx anyway*

4 Import Entities

In Thingworx Composer, import ... From File ... Type=Entity, Source=Single File, File Name= Entities.twx (or Entities.xml)

5 Create Dataset

Open Analytics Builder ... Data ... New:

Dataset Name = concrete

File Containing Dataset Field Configuration (JSON format) = concrete.json

File Containing Dataset Data (CSV format) = concrete.csv

Dataset has Header = True

6 Create Model

Open Analytics Builder ... Models ... New:

Model Name = concrete1

Dataset = concrete

Goal = CompressiveStrength

Filter = all_data

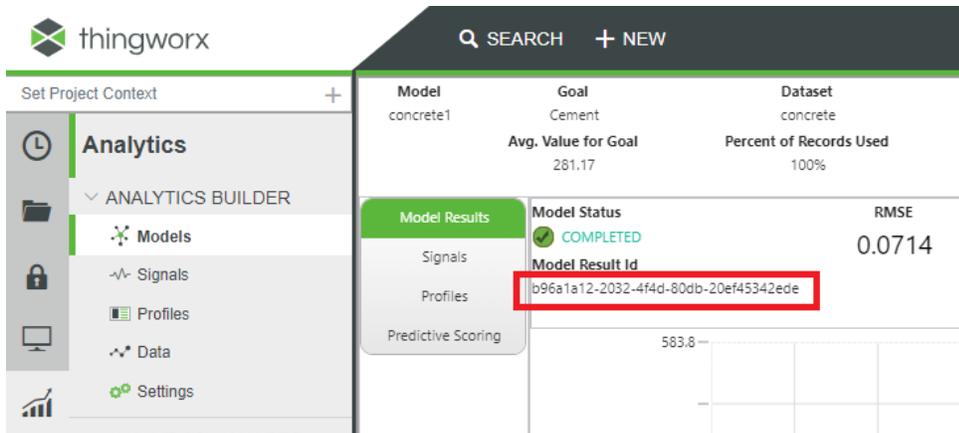
Excluded Fields from Model = none

Advanced Model Configuration tab = leave default settings

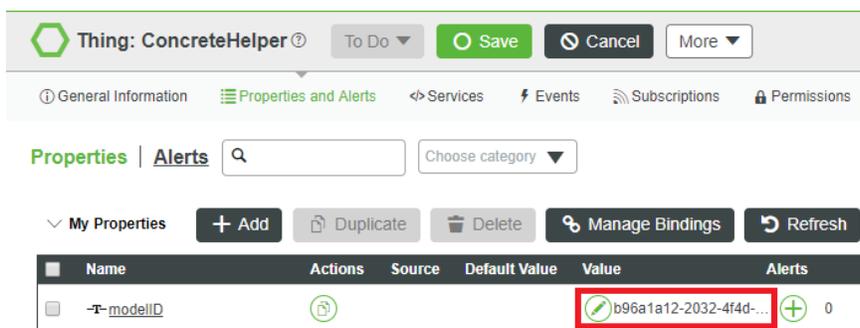
7 Set Model ID

Open Analytics Builder ... View Model ...

Copy Model Result Id to the clipboard as shown below:



Navigate to Thing: ConcreteHelper and set modelID value to the value in your clipboard as shown below:

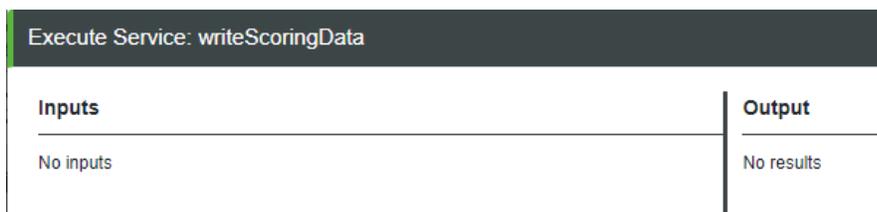


8 Write Scoring Data

We now need to write some records for scoring to a data table to make it easy to use the mashup (by loading pre-set values). In order to do this you need to execute the following service:

ConcreteHelper.writeScoringData

The service does not display any outputs after completion, see below:



9 Create Analysis Provider

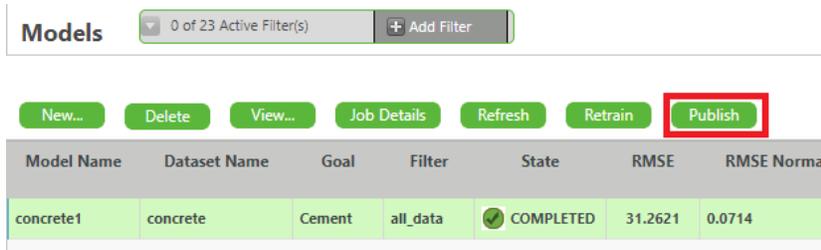
In Analytics Manager, create an analysis provider with the following details:

Provider Name = AnalyticsServer

Connector = TW.AnalysisServices.AnalyticsServer.AnalyticsServerConnector

10 Publish your Model

In Analytics Builder ... Models ... select concrete1 and click Publish.

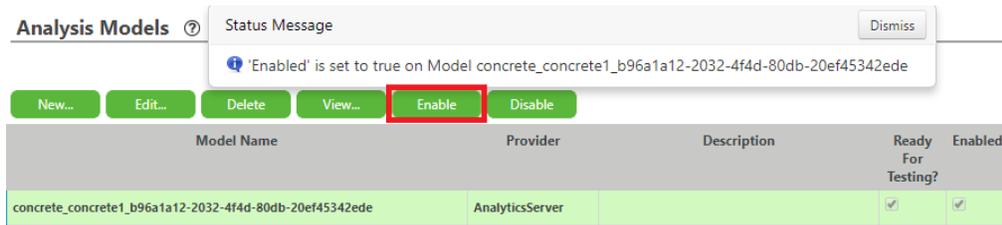


The screenshot shows the 'Models' section in Analytics Builder. At the top, there is a filter bar with '0 of 23 Active Filter(s)' and an 'Add Filter' button. Below this is a row of action buttons: 'New...', 'Delete', 'View...', 'Job Details', 'Refresh', 'Retrain', and 'Publish'. The 'Publish' button is highlighted with a red box. Below the buttons is a table with the following data:

Model Name	Dataset Name	Goal	Filter	State	RMSE	RMSE Normalized
concrete1	concrete	Cement	all_data	COMPLETED	31.2621	0.0714

11 Enable your Model

In Analytics Manager ... Analysis Models ... select your model and click Enable.



The screenshot shows the 'Analysis Models' section in Analytics Manager. At the top, there is a 'Status Message' box with the text: "'Enabled' is set to true on Model concrete_concrete1_b96a1a12-2032-4f4d-80db-20ef45342ede". Below this is a row of action buttons: 'New...', 'Edit...', 'Delete', 'View...', 'Enable', and 'Disable'. The 'Enable' button is highlighted with a red box. Below the buttons is a table with the following data:

Model Name	Provider	Description	Ready For Testing?	Enabled?
concrete_concrete1_b96a1a12-2032-4f4d-80db-20ef45342ede	AnalyticsServer		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

12 Create Analysis Event

In Analytics Manager ... Analysis Events ... create an new event with the following settings:

Create New Event

New Analysis Event

Analysis Event ?

General Information

Source Type (Required) : Thing

Source (Required) : ConcreteHelper

Event (Required) : DataChange

Property (Required) : _Cement

Alert Name : Not Applicable

Provider Name (Required) : AnalyticsServer

Model Name (Required) : concrete_concrete1_b96a1a12-2032-4f4d-80db-20ef45342ede

Retain Job History: None

Collect trailing data for: None

Save Cancel

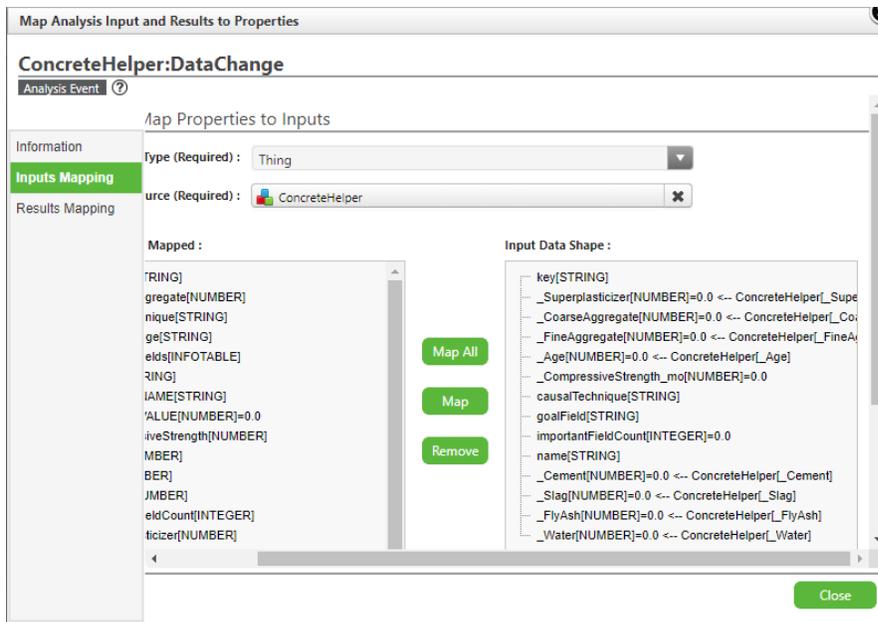
13 Event Inputs Mapping

In Analytics Manager ... Analysis Event select the event you created and click Map Data ...

Now select Inputs Mapping and set Source Type = Thing, source = ConcreteHelper and map the following inputs:

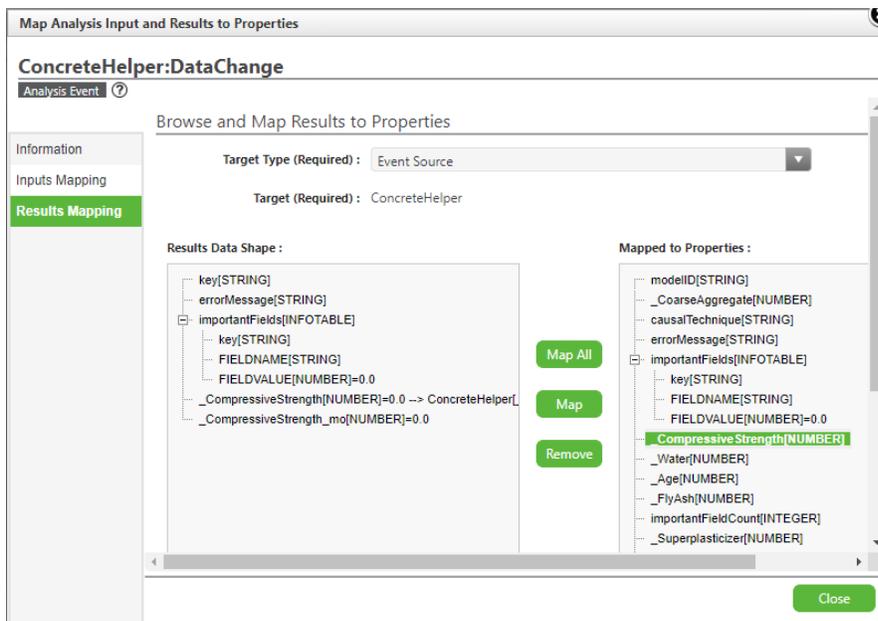
- _Superplasticizer
- _CoarseAggregate
- _FineAggregate
- _Age
- _Cement
- _Slag
- _FlyAsh
- _Water

See also the screenshot below:



14 Event Results Mapping

Map field `_CompressiveStrength` as shown below:



Click Close to exit this dialog.

15 Analysis Event: Enable

In Analytics Manager, select your event and click Enable as shown below:

Analysis Events ? 0 of 14 Active Filter(s) + Add Filter					
<input type="checkbox"/>	ConcreteHelper	DataChange	_Cement		AnalyticsServer

The Simple Prediction Mashup is now ready for use!

16 Using the Mashup

You can open the mashup by adapting this URL and then pasting into your browser:

<http://<your-servername:port>/Thingworx/Mashups/concreteMash>

You should see the blank mashup load as shown below:

Cement	<input type="text" value="0"/>	Identifier	<input type="text" value="0"/>	<input type="button" value="Load Values"/>
Slag	<input type="text" value="0"/>	Compressive Strength	<input type="button" value="Realtime Scoring"/>	
Fly Ash	<input type="text" value="0"/>		<input type="button" value="Reset"/>	<input type="button" value="Predict using Manager"/> Takes a few seconds ...
Water	<input type="text" value="0"/>		<input type="button" value="Batch Scoring"/>	
Superplasticizer	<input type="text" value="0"/>		<input type="button" value="Retrieve Result"/> <input type="text"/>	
Coarse Aggregate	<input type="text" value="0"/>			
Fine Aggregate	<input type="text" value="0"/>			
Age	<input type="text" value="0"/>			

The aim of the mashup is to allow you to enter inputs on the left and use the buttons on the right to trigger predictions using different methods. Additional hints / details are shown in the subsections below.

16.1 Load Values

The Load Values button allows you to load a pre-defined set of input data (to avoid having to type out all fields)¹. To do this, type in an identifier from 1 to 20 and click Load Values as shown below:

Cement	<input type="text" value="280"/>	Identifier	<input type="text" value="15"/>	<input type="button" value="Load Values"/>
Slag	<input type="text" value="72"/>	Compressive Strength	<input type="button" value="Realtime Scoring"/>	
Fly Ash	<input type="text" value="3"/>		<input type="button" value="Reset"/>	<input type="button" value="Predict using Manager"/> Takes a few seconds ...
Water	<input type="text" value="218"/>		<input type="button" value="Batch Scoring"/>	
Superplasticizer	<input type="text" value="0"/>		<input type="button" value="Retrieve Result"/> <input type="text"/>	
Coarse Aggregate	<input type="text" value="949"/>			
Fine Aggregate	<input type="text" value="671"/>			
Age	<input type="text" value="41"/>			

This will save you time, as you don't need to type input values manually, however you are free to do so, or to edit the input values if you wish.

16.2 Realtime Scoring

Once you have input some values you can click Realtime Scoring and you should see a Compressive Strength result shown in the middle of the screen. This is the prediction from the system of what the compressive strength would be for such a concrete mixture.

Cement	<input type="text" value="280"/>	Identifier	<input type="text" value="15"/>	<input type="button" value="Load Values"/>
Slag	<input type="text" value="72"/>	Compressive Strength	<input type="text" value="37.97"/>	<input type="button" value="Realtime Scoring"/>
Fly Ash	<input type="text" value="20"/>			<input type="button" value="Reset"/> <input type="button" value="Predict using Manager"/> Takes a few seconds ...
Water	<input type="text" value="218"/>			<input type="button" value="Batch Scoring"/>
Superplasticizer	<input type="text" value="0"/>			<input type="button" value="Retrieve Result"/> <input type="text" value=""/>
Coarse Aggregate	<input type="text" value="949"/>			
Fine Aggregate	<input type="text" value="671"/>			
Age	<input type="text" value="41"/>			

16.3 Predict Using Manager

This button demonstrates the use of Analytics Manager for getting a prediction based on input values. Set some input values, then click Reset, this resets the Compressive Strength result to 0. Now click Predict using Manager and after some seconds (around 10 secs on my system) you should see the compressive strength result update automatically.

Note that the script executed when you click Predict using Manager does not actually trigger the prediction directly. It only sets the input field values, however there is an Analysis Event which triggers when the input values change and this is what causes the predicted Compressive Strength to update.

16.4 Batch Scoring

Set your input values and click Batch Scoring. You get a job ID returned. You can now copy this job ID into the input box on the line below, and click Retrieve Result. The Compressive Strength prediction should update.

Cement	<input type="text" value="351.5"/>	Identifier	<input type="text" value="3"/>	<input type="button" value="Load Values"/>
Slag	<input type="text" value="140.5"/>	Compressive Strength	<input type="text" value="54.00"/>	<input type="button" value="Realtime Scoring"/>
Fly Ash	<input type="text" value="6"/>			<input type="button" value="Reset"/> <input type="button" value="Predict using Manager"/> Takes a few seconds ...
Water	<input type="text" value="222"/>			<input type="button" value="Batch Scoring"/> bff52e82-65c3-4445-9def-d6bb505ebb5b
Superplasticizer	<input type="text" value="0"/>			<input type="button" value="Retrieve Result"/> bff52e82-65c3-4445-9def-d6bb505ebb5b
Coarse Aggregate	<input type="text" value="939"/>			
Fine Aggregate	<input type="text" value="577"/>			
Age	<input type="text" value="277"/>			